

Chapter 4

EXCAVATION

Introduction

During the construction of a highway or bridge it may be necessary to remove existing materials. These materials occupy the space in which a new highway or bridge is planned. Therefore they must be removed or "excavated." There are eight types of excavation.

- * Common
- * Borrow
- * Rock
- * Unclassified
- * Waterway
- * Class Y
- * Class X
- * Peat

Some materials excavated may be suitable for use in construction of embankment. Some are not and must be disposed of completely. Disposal of excavated materials will be discussed later.

Common Excavation Section 203.02

Common excavation is the most frequently encountered type of excavation in the State of Indiana. The Standard Specifications state that, "Common excavation shall consist of all excavation not included as rock excavation or excavation which is otherwise classified and paid for; including existing flexible type pavement."

Common excavation is the excavation of soil materials from within the project limits. But it is not limited to soil materials only. It can also include existing flexible type pavement. This flexible pavement includes bituminous mixtures, macadam, crushed stone, bricks, cinders, etc. A rule of thumb is that if it is shown on the plans and is not a concrete pavement or another defined excavation then it will be considered common excavation.

Section 203 further defines excavation. "This work shall consist of ...excavation, hauling, and disposal or compaction of all material..." Because compaction of the material is included in common excavation it will be necessary to obtain soil samples. These samples are submitted to the appropriate testing laboratory for determining maximum densities and moistures.

Submitting Samples

The manner of sampling and the number and the size of samples required will depend upon two conditions:

* The number of different soil types used on the project. The submitter should investigate each cut and borrow pit to determine the soil types. Only samples of the different types encountered should be submitted.

* The method the contractor expects to use in the removal and placing of the soil. If each soil horizon or soil type is worked separately, it should be sampled separately. However, if the contractor expects to blend soil types, the soils should be sampled accordingly. Blending may occur during excavating or placing. Therefore communication with the contractor is very important.

If relatively few samples are to be secured, a 5 inch auger is a satisfactory tool for securing samples. Three foot extension sections of pipe may be required to reach the desired depth. The grading contractor should supply a backhoe with an operator for securing:

- A large number of samples.
- Samples at depths greater than five feet.

The grade technician may be required to determine where samples are to be taken, but may be required to obtain and submit the samples. Each soil sample will be a minimum of 25 lbs and granular materials a minimum of 65 lbs. A small portion of each sample needs to be retained for later reference.

Preparing
IT-530

When the samples are submitted to the District laboratory, they will be accompanied by an IT-530 for each sample. The following special information for each sample should be reported on the IT-530:

- Centerline station and offset.
- Centerline station and offset for adjacent borrow pits.
- Elevation.
- Field office telephone number.
- Copies of applicable special provision sheets.
- Referenced specifications.
- Intended use.
- Description of soil as to texture,color, etc..

The appropriate laboratory will determine the maximum density and optimum moisture. These results will then be sent to the PE/PS for use in determining in-place soil densities.

Rock Excavation

Rock excavation consists of the excavation of igneous, metamorphic, and sedimentary rock. It also includes boulders or detached stones having a volume of 1/2 cu.yd or greater. The material for this type of excavation is removed by blasting, by power shovel with a bucket that has a minimum capacity of 1 cu.yd, or by other equivalent powered equipment. Unless otherwise specified or directed, the following criteria will be used in excavating the material.

Exploratory Drilling	Exploratory drilling may be required to determine the existence of cavities and possible sink holes in cut sections. These holes will be 1 1/2" in diameter and drilled on centerline at 100' intervals. They shall be drilled to a point which is 7' below the proposed grade. If a cavity or sink hole is found then additional holes will be drilled along the edges of the pavement at 25' intervals. They will also be drilled to 7' below proposed grade. If the cavity has less than 5' of cover, then the cover will be removed and the cavity treated as set out in the plans or as directed.
Rock Pre-Splitting	<p>The rock shall be pre-split by the use of drilling and explosives. The work shall be done in such a manner that minimum breakage occurs outside the neat lines of the typical cross section. The holes for this operation will be from 2"-4" in diameter, spaced 3' apart, and drilled 2' below the established grade of the cut or the predetermined bench elevation. The maximum depth of a pre-split lift is 30'. If a cut section requires more than one lift, the holes are to be drilled in such a manner that the specified offset for each succeeding lift is obtained. A horizontal distance of 2' off the back side of the paved side ditch line is required.</p> <p>The pre-split face shall deviate no more than 6" from the front line and 1' from the back line of holes. The pre-splitting operation shall be kept well in advance of the regular blasting operations. The line holes are to be fired before the main excavation is blasted. There is no direct payment for pre-splitting. The cost is included in the cost of excavation.</p>
Explosives	The explosives to be used and the method of loading depends on the type of material to be blasted. It could vary from a single strand of detonating chord to a solid column of dynamite. The type used must be capable of pre-splitting the material with a minimum breakage outside the excavation area.
Primary Blasting	The holes for the primary blasting shall be drilled at least 6' away from the pre-split face. If additional charges are required, the holes will be placed at half the distance of the full depth holes. These holes will be drilled to a depth 2' above the pre-split face.
Restrictions	The contractor must restrict the amount of explosives used near structures, rock formations, or other property that may be damaged. Adequate seismograph readings shall be obtained if commercial buildings are within the effective

vicinity, at no additional cost. These readings will be used to show that the blasting operations have not altered the existing commercial building foundations.

Finished Grade	The final breakage of rock shall conform to or closely approximate the slope lines shown on the plans. The final slopes shall be left reasonably smooth and uniform with all loose and overhanging rock removed. Unless otherwise permitted, no rock shall project more than 1' beyond the established slopes. If a natural seam intersects an established slope, permission may be granted to follow the seam face for an approved distance. If the contractor can provide a finished slope which is equal or superior to that which is obtained by pre-splitting, he may use machine methods to establish final slopes. The rock will be excavated to the required elevation for the full width of the roadway as shown on the plans or as directed. The final surface of the rock excavation shall be such that there is proper drainage. If the rock is excavated below the required elevation, it will be backfilled to the subgrade elevation with crushed stone, spalls, subbase material, or other granular material.
Unclassified Excavation	Unclassified excavation consists of the excavation of and proper disposal of any type of material that is encountered during the progress of the work.
Waterway Excavation Section 203.06	Waterway excavation consists of excavation and the proper disposal of material involved in the clearing of the waterways, making channel changes, or a combination of the two. It does not include Class Y excavation or the excavation made for a structure as set out in Section 206. Waterways shall be cleared between the right of way lines unless otherwise specified. Surface objects, trees, stumps, and roots will be cleared and grubbed.
Class Y Excavation Section 203.07	While performing normal waterway excavation, material may be encountered such as rock, or material which consists of hard ledge rock, hard shale, conglomerate, concrete, masonry, or any similar material which is not part of the existing structure as shown on the plans. If the material cannot be reasonably removed by any other method, it shall be removed by blasting. This excavated material is defined as Class Y excavation. Hard pan is not considered as Class Y excavation.
Class X Excavation Section 206.02	One or more of the following materials encountered within the limits of foundation excavation will be defined as Class X excavation.

* Solid rock, hard ledge rock, slate, hard shale, or conglomerate. Because the material cannot be reasonably removed by any other method, it is removed by blasting or pneumatic or equivalent tools.

* Loose stones or boulders which are greater than 1/2 cu.yd in volume.

* Concrete, masonry, or similar materials which are parts of an old buried structure that was not shown on the plans.

* Timber grillages, old foundation piling, buried logs, stumps, or similar material that extend beyond the limits of excavation and have to be cut off to be removed. They will be removed back to the cofferdam limits and paid as Class X excavation.

Hard pan will not be considered as Class X excavation. The limits of Class X excavation will be neat lines of the footer unless the excavation lies above another type of excavation whose limits are different. In this case, Class X excavation will be paid to the limits of the material beneath it.

Disposal Of
Excavated
Material
Section
203.10

Excavated material may be classified as follows:

* If the material removed is suitable then it shall be used for construction of embankments, shoulders, special fills, or other places as specified or directed depending on the nature of the fill.

Suitable
Material
Unsuitable
Material

* If the material is unsuitable for use in the embankment it shall be removed from the right of way. To place unsuitable material on private property, the contractor must have written permission from the property owner.

Excess Material

* Any excess excavated material that cannot be constructively used within the project limits may be disposed of off the right of way, or used as directed to widen embankments or to flatten fill slopes.

* Excavation obtained from within the right of way and planned to be used in the embankment may be wasted and replaced with borrow if permission is obtained. The borrow, however, will not be paid for.

Borrow
Section 203.08

Borrow is a material obtained by the contractor from locations outside of the right-of-way to complete the planned grading section. Frequently this material is obtained from properties adjacent the right-of-way. Many of the areas that are "borrowed" from become ponds or small lakes. Hence the term "borrow pit".

Material such as muck, cinders, or a soil mixture with a high organic content shall not be used. Borrow material should be free of substances that will:

* Form putrefying (rotting) deposits.

- * Form deleterious (harmful) deposits.
- * Produce toxic concentrations or combinations that may be harmful to human, animal, plant, or aquatic life.

Borrow material not suitable for the growth of vegetation

such as the following examples may be used:

- * Granulated popcorn slag.
- * Dunes sand.
- * B-Borrow.
- * Other granular material.

When these materials are used they should not be placed with 1' of the required finished grade of shoulders and slopes. The final 1' should be of material suitable for the growth of vegetation. This material should be free from clods, debris, and stones.

Contractor Responsibilities

When borrow is necessary the contractor must submit an operation plan for approval which includes the following:

- * A detailed sketch showing limits relative to property and right-of-way lines;
- * The grade of all slopes;
- * The enhancement, finishing grade, and seeding procedures;
- * Providing an erosion control plan for the borrow pit in accordance with 327-IAC 15-5
- * An archeological clearance. The archeological report must be performed by a qualified archeologist. A record check and an intensive field survey will be performed. Prior to the excavating of any material, a written report of the results should be furnished to the Engineer. If any archeological sites are identified, the archeologist will establish its limits along with a reasonable border and the Contractor shall remain clear of the site unless the archeological site is cleared by established procedures and written authority has been issued by the Engineer. Under no circumstances will an employee of the Contractor or the State of Indiana share in the ownership or profit from the sale of any archeological artifacts that may be salvaged.

Preparing A Borrow Pit

Section 203 of the standard specifications places limits on the location, planned excavation, and control of the drainage of the borrow pit. If the location, planned excavation, and material comply with specifications, the contractor may proceed with clearing the borrow pit site. Soil samples of the pit are taken and forward to the District Testing Department. Before any borrow material is removed from the pit, a base line must be established and original cross-sections taken. The base line is established through or near the proposed borrow pit with the extremities of the line referenced outside of the excavated area.

Precautions are to be taken to insure that the references are not disturbed. In establishing a base line, consideration should be given to the topography, the line of the cross sections, and the possibility of extending sections, if necessary. If the borrow pit involves a large area, it is suggested that an auxiliary line be run parallel to the base line to properly align the cross sections. Unless written permission is granted, there shall be no excavation below the elevation of the adjacent properties in a borrow pit within 150' of the nearest right of way line of an existing highway. A sketch must be made of the borrow pit layout in the permanent field notes immediately preceding the original cross section notes. A description of the location of the borrow pit is placed on the sketch, such as, the number of feet right or left of a roadway station. The name of the property owner is also placed on the sketch.

Peat Excavation
Section 203.16

Introduction

Peat is partly decayed plant matter that has collected in swamps and marshes over long periods of time. It is generally the first stage in the formation of coal. Dried peat varies from a light yellow-brown substance, to deeper layers of dark brown, compact material which looks like brown coal. Although peat is useful as fuel, fertilizer, packing material, and animal bedding, it is not suitable for foundations of roadways. It is unstable and subject to settlement when additional embankment is placed upon the deposit. It must therefore be removed from under the roadway.

Peat excavation is the removal and satisfactory disposal of peat, muck, marl, or any other unsuitable material in peat deposits. It also includes any overlaying material. Muck is extremely soft organic silt found on river and lake bottoms. Muck deposits are usually shallower than peat deposits. Marl is sometimes found immediately below peat. Marl is a water-deposited sand, silt, or clay containing calcium carbonate. Marl is often hardened into soft rock.

In rolling country where the ground rises sharply from the peat deposit, soils have often been washed over the edge of the original peat deposit. Some peat may therefore be trapped under what appears to be the soil perimeter of the peat deposit. This too is considered to be peat excavation.

Excavation Of Peat Deposits

Removal of peat deposits may be accomplished in several ways. Methods of treatment may be shown on the plans, as directed, or as per methods outlined in the specifications. Because treatments detailed on plans, or as directed are not all uniform in application, only the methods outlined in the specifications will be discussed.

The Standard Specifications detail three methods for treatment:

- Treatment of existing fills.
- Treatment by removal.
- Treatment by displacement.

Treatment Of Existing Fills

Treatment of existing fills is a method used to change a fill over an existing peat deposit. The change may be in height and/or width. Treatment of existing fills may be accomplished by several means. This method is usually predetermined and outlined in the project plans.

Treatment By Removal

The method of treatment by removal consists of completely removing the objectionable material by machine operations. This method is usually used when the following conditions exist:

- The peat deposit is small in size.
- The peat deposit is shallow in depth.
- The peat deposit limits are completely within the construction limits or right-of-way.

The following will take place during this method of treatment by removal:

- New original cross-sections will be taken. The entire area may have settled since the original survey.
- The width of excavation is to be the full toe of slope to toe of slope width of the proposed embankment.
- Final cross-sections will be taken after the excavation is completed.
- Backfilling of the peat excavation should follow as soon as possible to minimize the occurrence of slides.
- If water is not present, the excavation may be backfilled with borrow or common excavation.
- If water is present, the backfill will be B-borrow placed by end-dumping to an established grade of approximately 2' above free water level.

Treatment By Displacement

Treatment by displacement is the most commonly used procedure for excavation of peat. It is frequently used under the following conditions:

- The peat deposit is large in size.
- The peat deposit is deeper than 10'.
- Water is present at all times.
- The free water level is high.

The following steps are usually followed during this method of treatment, if conditions permit:

- Each end of the deposit is removed until the depth of the peat excavation is greater than 10'. This may be subject to change as directed.
- If conditions permit, the upper portion of peat is excavated across the remainder of the deposit. Excavation of this upper level begins at one end and continues ahead of the displacement-backfill operation. The free water level usually controls the depth of this operation. Displacement-backfill operation is also known as "surcharge" and will later be discussed in detail.
- After the completion of the excavation, cased test holes are placed. These test holes determine the extent of peat displacement, and are also used to determine final measurement of the excavation.

The surcharge operation is the most difficult portion of the treatment to control. The weight of the surcharge literally pushes or squeezes the peat from the deposited area. A crane(s) with a drag line assists the surcharge by removing the peat from in front of the surcharge. Since a properly constructed surcharge is very important, several guidelines will be followed during it's construction:

- The surcharge will be constructed of B-Borrow.
- The top of the surcharge will be constructed and maintained to a width equal to the full shoulder width of the embankment.
- The height of the surcharge will be the same as the depth of peat being excavated. The original ground is the reference elevation for measuring the peat depths and the surcharge heights.
- The top of the surcharge will be approximately level.
- The length on the top of the surcharge will be at least 2 times the depth of the peat being treated.
- The surcharge will be maintained and pushed forward as directed.
- The crane operation will be coordinated with the rate of placing the surcharge.

Peat Disposal

Once the peat deposit is excavated, by either removal or displacement, the excavated peat may be disposed of by several methods:

- Uniformly spread between the toes of fill slopes and the swamp ditch lines and beyond.
- Or according with 203.08 (Disposal Sites).